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The effect of biofouling on taste of permeate water in reverse osmosis membranes

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Abstract

This paper addresses the purpose and priorities that should be taken into account during the design of the reverse osmosis systems. In water treatment processes by reverse osmosis (RO), the biological fouling (biofouling) in RO membrane is a major threat to system operation which may causes foul tastes and odors in permeate water. In this study, the role of ozonation (the disinfection by ozone) for preventing the foul tastes and odors of permeate water in RO membranes was investigated. In the present study, two RO identical pilot plant units have been used. In the first one the ozone was used to disinfect the feed water prior the RO membrane while in the second unite; the feed water was not disinfected. The taste, odors, total dissolved salts (TDS) value and the PH value of the permeate water of these two pilot plant were the main parameters have been employed to diagnose the affecting of ozonation. The results showed that the using ozonation in the first unit was efficient to prevent the foul taste and odors in permeate water.

Keywords: biofouling, permeate, taste and odors, reverse osmosis, ozone.

Introduction

All raw water contains microorganisms such as: bacteria, algae, fungi, viruses and higher organisms. Microorganisms can be regarded as colloidal matter and removed by the pretreatment. One of the problems of membranes in water treatment for drinking water treatment is biofouling. Biological fouling is the growth of bacteria on the membrane surface. The susceptibility of membranes to biological fouling is a strong function of the membrane composition, and biofouling in RO is a problem of formation of an unwanted biofilm. A biofilm is defined as, a surface accumulation. Hence, The foul tastes and odors in permeate water appearance as a result of biofouling. The objective of this study is to describe the role of ozone in prevention of taste and odors appearance of permeate water by killing the microorganisms in feed water of membranes.

Methods

Two alike pilot units (using disinfection by ozone for the feed water of RO membrane & without using disinfection by ozone) were used. The time of operation was ten hours in day and the samples of water which used in this study have been taken from Tigris river (Iraq).

Results

All the values of TDS and p H of permeate water of a two a like pilot units have been measured for twenty weeks are and reported and presented in Figures: 5 & 6.

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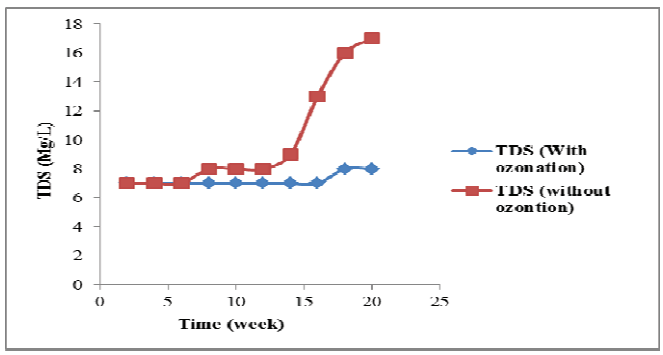

Figure 5: The effect of operation time (week) on TDS value (mg/l)

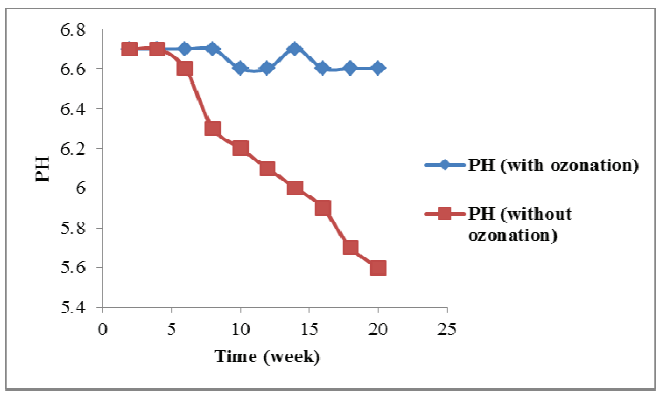

Figure 6: The effect of operation time (week) on pH value reference

Based on Figure 5, the TDS value was 7 ppm for eighteen week of operation, i.e. the TDS has not change handsomely. Furthermore, the % TDS rejection has not decreased by time with ozonation (ozone disinfection). At this value of TDS, no foul taste and odors in permeate water can be observed by consumer. But, without using ozonation for feed water, after fifteen week of operation, TDS value was 9 ppm and has been increased into 17 ppm after twenty week of operation. I.e. the TDS rejection has been decreased from 98.09 (fifteen week of operation) into 96.19% (after twenty week of operation). At this value of TDS, a foul taste and odors in permeate water can be observed by consumer.

Based on Fig. 6, the PH value for eighteen week of operation also has not changed handsomely (with ozonation). At this value of PH, no foul taste and odors in permeate water can be observed by consumer. But, without ozonation for feed water, the PH value has been change handsomely from 6.7 of five weeks of operation into 5.6 after twenty week of operation. At this value of PH, a foul taste and odors in permeate water can be observed by consumer.

Discussion

Because of biofouling, the biofilm layer can produce acids, other characteristics and carbon dioxide which can permeate from membrane and decrease the PH of permeate water that can causes foul taste & odors in permeate water. Based on these results. The disinfection of feed water of membranes by ozone could be an effective alternative to prevent appearance of these foul tastes & odors of permeated water in RO membranes, by prevention of biofouling occurring. These results help explain why foul taste and odors are appear in permeate water and the preventive method for this problem.

Keywords: Biofouling, Permeate, Taste and odors, Reverse osmosis